

CRITICAL EXPLORATION IN THE CLASSROOM ITS PAST AND PRESENT

Yeh Hsueh

Critical Exploration has two aspects: (1) developing a good project for the child to work on—developing a curriculum; and (2) succeeding in inviting the child to talk about her ideas—developing pedagogy: putting her at ease, being receptive to all answers; being neutral to the substance of the answer while being encouraging about the fact that the child is thinking and talking; getting the child to keep thinking about the problem, beyond the first thought that comes to her; getting her to take her thinking seriously.

Eleanor Duckworth (2003)

The approach of Critical Exploration in the classroom, also known as teaching-research or extended clinical interviewing, is new to many people in education, even though it is rooted in a clinical tradition dating from the early 20th century. Nevertheless, a variety of clinical approaches that continue to abound in various shapes and forms are familiar to many. The “clinical method” is often applied to a wide range of curricular activities required in teacher education and special education programs. Although the topic here can be related to educational clinical variation, the purpose of this chapter is not to seek a possible affiliation to other clinical approaches, but rather to provide some background of Critical Exploration and to describe a number of principles that characterize the ideas embedded in this unique educational practice.

In this chapter, I first clarify and define the approach itself. This preliminary definition raises the question of how the approach developed over time, which I attempt to describe. The historical description inevitably invites a contemporary and practical question about how this approach will work in a classroom setting. Following an example from Duckworth teaching a poetry class, I discuss four basic principles of Critical Exploration that involve the issues of “opening the world” with all its complexity, developing collaboration, thriving on multiplicity and conducting research while doing Critical Exploration for learning and teaching.

WHAT IS CRITICAL EXPLORATION?

This approach is a learning-teaching-research activity in which students and the teacher are mutually engaged in exploring the world of the subject matter, and in which the teacher’s learning is an essential part of her teaching and research.¹ “Activity” means active personal pursuit of a firsthand experience with objects to be studied. In this activity, students’ direct contact with a concrete object is crucial, be the object a poem, a historical event, a mathematical function, a theoretical model, a plant, or a cow. The direct contact is meant to get students to interact with various aspects of the object with their hands, heads and hearts.

For example, when children visit a farm and learn to milk a cow, milking could allow rich connections with other aspects of children’s own experience, e.g., with dairy products, with the concept of Pasteurization, or with cow’s digestive system, and so on.

Keeping the contact with the object active and meaningful requires the teacher to make every effort to get students to grapple with the object in their own ways. In order to help students seriously pursue their own ideas, the teacher encourages them to explain what they have experienced with various aspects of the object by closely following, relating and provoking their explanations and reasoning. Often, the students’ efforts to explain their understandings of the object further stimulate their own interest in the matter under study.

The activity also provides an opportunity for the teacher to learn. In addition to its usual connotation of the word “learning,” the teacher’s learning through Critical Exploration entails three levels of meaning:

¹ As a convenience, I use the pronoun “her” throughout this chapter when referring to teachers.

- a. teacher's learning of students' knowing,
- b. teacher's learning of her own understanding of the students' thinking,
- c. teacher's learning as a way of conducting research of her own teaching.

This research level overlaps with the other two because, as mentioned at the outset, Critical Exploration in the classroom, also called teaching-research, engages students in thinking about specific subject matters, and follows the development of their ideas. By following how the students' ideas develop over time, the teacher actually conducts research on learning and teaching, and applies the findings of her research to her teaching. For example, Quintero (2001) worked with a group of third grade children in Puerto Rico over a dozen sessions to understand these children's understanding of local geography and of mapping. Delaney (2001) studied high school boys' developing understanding of the U.S. presidency by asking them what they noticed about photographs and articles, selected on the basis of their ideas. And Schneier (2001) worked daily for five weeks with a group of high school freshmen, helping them come to understand complexities of poetry.

Teaching-research is to be distinguished from both "research for teaching" and "teacher as researcher" in that there is no demarcation between the role of a teacher and that of a researcher. In this sense, it is like a clinical interviewing process in psychotherapy that requires the therapist to investigate the patient's thoughts in order to help the patient move forward in his life through his own actions. Like the therapist's work that often extends over time, teaching-research functions to understand students' learning over time (Duckworth, 1996). The second meaning in the case of the latter is its interactive feature that extends from the individual to the group. That is why this approach is also often called "extended clinical interviewing." Only in recent years has Duckworth applied the name "Critical Exploration" to her educational practice (Duckworth, 2003). Historically, this term and research practice is an extension of the empirical epistemology pioneered by Piaget and his colleagues.

HOW DID CRITICAL EXPLORATION EVOLVE?

An inquiry into the evolution of this educational practice inevitably leads to an examination of Jean Piaget's early scientific activities. In this section, I identify some historical evidence to outline the development of Critical Exploration.

As far as the genesis of this approach is concerned, it is helpful to examine the period after Piaget received his doctorate in science. He spent a year in Zurich between 1918 and 1919 in the hope of finding a psychological research method that would allow him to implement his philosophical studies. Piaget (1952a) attended the lectures of Carl Jung and Oskar Pfister, studied statistics and spent much time with Eugen Bleuler who was an expert on autism, which Bleuler believed was a tendency to rely on wish-fulfilling fantasies as a flight from objective reality. Bleuler's teachings made Piaget "sense the dangers of solitary meditation" (Piaget, 1952a, p. 244).

Piaget went to Paris in 1919 to work for Theodore Simon in the laboratory school of the late Alfred Binet, the best-known pioneer of intelligence testing. Simon gave Piaget both a task and a free-hand. The task was to standardize British psychologist Cyril Burt's intelligence tests by using them with the laboratory school children. In the morning, Piaget would go to the library to read or attend lectures at the Sorbonne (University of Paris) where Lèon Brunschvicg, a philosopher of science, in particular, "exerted a great influence on [him] because of his historical-critical method and his references to psychology" (Piaget, 1952a, p. 244). In the afternoon, he talked for long hours with children in the school who found "Monsieur Piaget's" questions quite amusing. While he engaged children in various long, free-flowing conversations, Piaget discovered the questioning patterns of psychiatric workers most helpful in revealing the reasoning processes that underlay the children's answers.

This was the beginning of what was later called Piaget's "clinical method," and was the beginning of his experimental era even though, at the time, the method had no name. A strong psychoanalytical vein was evident in Piaget's method which he finally brought into being in Paris. And yet this vein cannot be credited as the formative influence in Piaget's method. There were more important ideas behind the method than psychoanalytical ones.

An important fact that has often escaped critics of Piaget's work is the profound influence of Brunschvicg's teaching on him which, in my view, was the engine that drove him to borrow from psychiatric procedures. According to Piaget, two aspects of Brunschvicg's influence were crucial. One was the previously mentioned historical-critical method that focuses on the mechanism and instruments through which earlier ideas and reasoning influence the formation of subsequent ones (Piaget & Garcia, 1989).² The second influence of Brunschvicg was the belief that the active

² In their studies of creative people at work, Gruber and Wallace (2001) described this intellectual development as the Network of Enterprise—a continuous flow of idea development

exchange of ideas is essential to scientific work. Any scientific objectivity can be achieved only through collaborative work—understanding, verifying and improving each other's ideas (as exemplified in Piaget, 1995, 1966, 1965, 1929). The research method that he and his colleagues used to investigate children's thinking embodied this view and so did his theoretical work.

In 1921, Piaget joined the Jean-Jacques Rousseau Institute where he soon drew up a plan to do a series of four books exploring child logic (Gruber & Vonèche, 1995).³ In those days, Piaget taught and led his students to do research in la maison des petits (the House of Little Children) which was both part of the Institute and a public elementary school in Geneva. Édouard Claparède (1925), Director of the Institute, introduced the Institute to the U.S. audience, and described Piaget's investigation of children's logical thinking as "clinical examination" (p. 94). By the time Claparède made this comment, Piaget was writing *The child's conception of the world* in which, for the first time, he delineated his "method of clinical examination" and specified the rules and criteria for diagnosing and interpreting children's verbal responses. He made it clear that this method of clinical examination was analogous to the method employed by psychiatrists as a means of evaluation:

For example, one may for months examine certain cases of paranoia without once seeing the idea of grandeur assert itself, though the impression of it is behind every unusual reaction. Moreover, though there are not differentiated tests for every type of morbid condition, yet the practitioner is able both to talk freely with the patient whilst watching carefully for evidence of morbid obsession . . . naturally without knowing exactly where the obsession may suddenly crop up, but constantly maintaining the conversation on fertile soil (Piaget, 1929, p. 7).

This analogy suggests that the actual clinical examination sustains a relationship with another person, be it a child or a psychiatric patient, over a long period of time, with searching attention and strenuous effort given to following that person's thought. The practitioner was

that, from time to time, may branch out to form new enterprises or fuse with already existing ones. The result is a web of co-existing and sequential enterprises that at any given point represents the purpose of the person at that point. The enterprises can be active or dormant at different phases of development while significantly or potentially being connected with one another. Piaget's lifelong research activities demonstrated this evolving network of enterprise.

³ These four books are: *The language and thought of the child* (1923); *The judgment and reasoning of the child* (1924); *The child's conception of the world* (1926); and *The child's conception of physical causality* (1927). See also a recent review of Piaget's method by Mayer (2003).

responsible for providing a continuous and enriching range of topics that could reveal, in the conversation, the thinking process of the person. By purposefully pursuing this process, the practitioner conducted an experiment:

This clinical examination is thus experimental in the sense that the practitioner sets himself a problem, makes hypotheses, adapts the conditions to them and finally controls each hypothesis by testing it against the reactions he stimulates in conversation. But the clinical examination is also dependent on direct observation, in the sense that the good practitioner lets himself be led, though always in control, and takes account of the whole of the mental context, instead of being the victim of "systematic error" as so often happens to the pure experimenter (Piaget, 1929, p. 8).

In this passage, the dual quality of experiment and direct observation in one process was probably the most striking dialectical feature of the clinical examination. Conceived as an on-going process, this method sets itself apart from other research methods in that it seeks and preserves every response from the child in its living context. "The context may be one of reflection or of spontaneous belief, of play or of prattle, of effort and interest or of fatigue" (Piaget, 1929, p. 10).

In 1933, on the occasion of giving a talk to history teachers at an international conference, Piaget (1933) introduced the "clinical method" to teachers. First, he pointed out the deficiencies of preset questions in the questionnaire method that was popular at the time with both teachers and psychologists who studied children. Then he turned to the method he and his students used in Geneva:

Therefore, little by little, the questionnaire method is being superceded by the direct questioning of the child, in a free and easy conversational form. This may be called the "clinical method". It is sure and has given converging results, but it is laborious, slow and difficult, like any other scientific analysis (Piaget, 1933, p. 17).

The last sentence is characteristic of descriptions of the clinical method. Furthermore, this scientific method was being introduced to history teachers! The laborious, slow and difficult process, according to Piaget, was important to teaching history because it was meant for studying "the child's spontaneous intellectual attitudes" (Piaget, 1933, p. 18) toward the historical event and its relation to the present, the subject matter that children needed to learn. As a scientific analysis, this clinical method carried a broader meaning than the usual hypothesis-testing and empirical verification. Piaget seemed to see in his research method a potential value for teaching history in the classroom.

But in the 1930s, a major watershed was apparent in his method of clinical examination. In an interview with Richard Evans (1973) who asked Piaget what he did wrong in his early work, Piaget replied, "Oh, my errors. I believed in language too much. I had the children talk instead of experiment... I wasn't sensitive to that. It wasn't until I had my own children and saw what they did before language..." (Evans, 1973, p. 70). This was not the first confession from Piaget. The arrival of his children in the late 1920s piqued his interest in pedagogy (Piaget, 1952a). In 1953, he remarked that, "it was essential to go back to the actions themselves, to the reasoning which is carried out not through language but through manipulation of objects. Starting with my books on the first and second years of child development my technique has always been to study reasoning through objects set up so that the child could make certain experiments" (Tanner & Inhelder, 1956, p. 32). The watershed was revealed in the new empirical experimental method in Piaget's books. The first of these books that he referred to is *The origins of intelligence in children* (1936/1952b) which first appeared in English in 1952. Almost 70 years later, this book is still considered by developmental psychologists in the English speaking world as "the Number One most revolutionary study since 1950" (Dixon, 2002, p. 4).

Researchers such as Gallagher and Reid (1981), Ginsburg and Oppen (1979), Gruber and Vonèche (1995), and Inhelder, Sinclair and Bovet (1974), have noted this significant emphasis on action, a modification of the early clinical method. Ginsburg and Oppen (1979) also coined the term the revised clinical method. After concluding his infancy study in the mid-1940s, Piaget stopped interviewing children, a research activity he had pursued for almost thirty years. Bärbel Inhelder who, some American social scientists in the 1950s believed, would soon succeed Piaget (Hsueh, 1998), became responsible for training students and researchers. About this time, Piaget took to using the term critical method, rather than clinical method (Bang, 1988, p. 40), partly derived from Brunschvicg's historical critical method. The alternating use of "critical" and "clinical" continued until the 1970s when Inhelder and her colleagues combined the "clinical method" with experimentation through a longitudinal design, and explicitly brought forth the method of critical exploration (Inhelder, Sinclair & Bovet, 1974, pp. 18-24).

"Clinical" maintains the sense of continuous, descriptive and reflective qualities; but "critical" adds the idea of the empirical experiment which involves the objective world. The idea requires "a more directive experimental method" because the purpose of this method is to provide children with optimal opportunities for interaction, both with the physical environment and with the experimenter (Inhelder, Sinclair & Bovet, 1974, p. 24). In

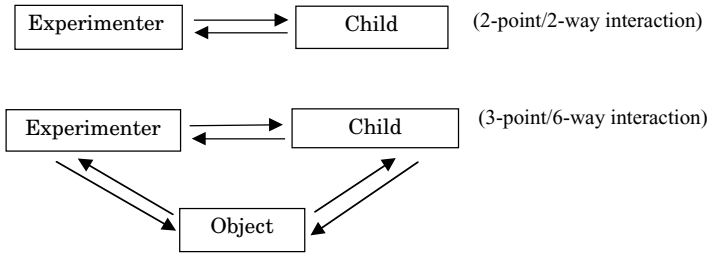


Figure 1.

fact, the “critical exploration” was an outgrowth of “clinical examination.” The word “clinical” was initially a deliberate choice to set Piaget’s method apart from testing or questionnaire methods that were common in the 1920s and beyond (Bang, 1998; Piaget, 1933). “Clinical” also acknowledged the psychoanalytical tradition (Piaget, 1929), empathetic listening to what the child had to say, and careful examination of how the child’s earlier thoughts and feelings shaped current ones. This characteristic ran against the prescribed questions in the questionnaire method. The watershed in Piaget’s method—shifting from the “clinical” to the “critical”—de-emphasized verbal interaction as the single most important means by which to look into children’s thinking. “Critical” conveys a meaning which the commonplace “clinical method” often lacks, namely, the experimental adventure.

The method of critical exploration, proposed in the 1970s, invited participants to tell their beliefs, arguments, and reasoning through acting on objects, or the physical environment, and interacting with the interviewer/experimenter. This emphasis added a third interactive point to the earlier two-point/two-way interaction between interviewer and interviewee in the clinical method: the physical environment made the interaction three points and six ways. It also projected an educational possibility because the experimenter, like a teacher, was involved in the child’s learning.

This methodological concept, articulated by Inhelder, Sinclair and Bovet (1974), embodied a dual focus: on development and on exploratory actions through experimental adventures. It has informed the present discussion of a pedagogical derivation in education: the approach of Critical Exploration in the classroom.

The use of the term, “approach” instead of “method” widens the application of “critical exploration” in a variety of learning and teaching contexts, in which participants act on things rather than only talking about things. This interactionist position was held firmly by Piaget, and is a key idea in Eleanor Duckworth’s work with teachers (Duckworth, 1997, 2001). She valued two main inspirations for her career in studying teacher

education: Piaget's work and her own experience with Elementary Science Studies, a group of science curriculum developers in the 1960s (Duckworth, 1996).

Duckworth studied with Piaget in the late 1950s and served as his interpreter when he toured and lectured in the United States during the last fifteen years of his life. But for her thorough grasp of the method, Duckworth credited Bärbel Inhelder "at whose side and through whose patience I learned, among other things, the practice of clinical interviewing" (Duckworth, 1996, p. ix). Inhelder (1989) recalled that, in the 1960s, she began introducing her students to a method that combined two orientations:

one where the researcher studies individual subjects keeping in mind a theoretical problem of genetic epistemology and psychology, and one where the psychologist or psychiatrist studies an individual human being in order to understand his or her specific potentialities and difficulties. (p. 233)

These two orientations, in retrospect, not only revitalized the early methodological insights, but also initiated a varied method called for by new problems regarding the relationship between learning and the development of cognition. They pointed in a direction of research that Piaget, except in his infancy research, had not always been interested in doing: studying individuals' learning over time (Duckworth, 2001, p. 186; Gruber & Wallace, 1999, p. 97). But this was Inhelder's long-time interest, witness especially her longitudinal studies (Hsueh, 1998). In a series of studies, Inhelder, Sinclair and Bovet (1974) refined the clinical method to allow quasi-naturalistic observations of behavior with a paradoxical emphasis: helping children think differently without telling them what to think, which amounts to a novel aspect of critical exploration.

In a similar vein, Duckworth made further methodological advances suitable for teacher education, one that takes account of individuals' learning in a group. This approach deals with learning, teaching and research through the teacher's and students' involvement in shared activities over time. As she moved from psychology to teaching, Duckworth noticed how her interviewing process concurrently helped to pique learners' interests, seize their attention and spur them on to further learning. This insight arose from the effort to help learners take their own thinking seriously, pursue their own questions, and wrestle with their own confusions while the teacher actually conducted research on their developing ideas (Duckworth, 1996). The approach stimulates learning activities without spelling out exactly what the learner should do. For two decades, she and her colleagues have documented diverse experiences of teaching-research in classrooms

(Duckworth, 1986, 1987, 1996, 1997, 2001; Duckworth, Julyan & Rowe, 1985; Julyan & Duckworth, 1996).

Critical Exploration is different from its forerunners in psychology because it is grounded in extensive work with teachers, children, and different kinds of adult learners in a variety of subject areas. Unlike any experiments in the psychological laboratory, the participants are learners in school and in everyday life. The teacher seeks an understanding that will be helpful to them. In this sense, Critical Exploration is also to be distinguished from most educational research that is conducted by those who are not responsible for teaching a subject or developing a curriculum in schools.

FOUR PRINCIPLES OF CRITICAL EXPLORATION IN THE CLASSROOM

Critical Exploration is itself a teaching and learning process. It may be helpful first to quote an example from Duckworth (1996) and then discuss its basic assumptions. This example happens to be about exploring a poem, but—as Duckworth pointed out later—people establish access to poems in multiple ways just they do in science.

When studying a poem with a class, I start by asking students what they notice—an invitation to keep every complexity of the poem under consideration. People notice very different things, and almost every thing noticed leads to a question or another thought. Putting together what everyone notices and returning to the poem to try to look for answers to the questions leads to an understanding of the poem that is greatly expanded for each of us. Take, for instance, this Frost poem:

Design

I found a dimpled spider, fat and white,
On a white heal-all, holding up a moth
Like a white piece of rigid satin cloth—
Assorted characters of death and blight
Mixed ready to begin the morning right,
Like the ingredients of a witches' broth—
A snow-drop spider, a flower like froth,
And dead wings carried like a paper kite.
What had that flower to do with being white,
The wayside blue and innocent heal-all?
What brought the kindred spider to that height,
Then steered the white moth thither in the night?
What but design of darkness to appall?—
If design govern in a thing so small.

(Frost, 1969, p. 302)

Somebody will notice that there is a lot of white. Somebody will mention the rhyme scheme, or will imitate the rhythm. Somebody will mention that the first part of the poem seems to present a picture, and the second half seems to ask questions about it. Different people point out different possible plays on words: kindred and dreadful kin; ap-pall and a funeral pall; a paper kite and a bird kite; morning right and morning rite; morning and mourning. Different people have different thoughts about whether the darkness is that which appalls, or that which is appalled.

Arguments develop about why the flower is described as white in the first line, and blue in the ninth. This is a bare beginning. A group of adults can easily go on for more than an hour with increasing interest and everybody's initial understanding is expanded by hearing from others.

I have always been frightened by being asked: "What is the meaning of this poem?" My reaction is, "How could I know? I'm no good with poems!" But it is easy for me to point out something that I notice about it. And in turn to listen to what other people notice about it, and to figure out whether I think that what they say makes sense, and why, and what other thoughts their ideas provoke in me. Many students have feelings similar to these. One in particular said that she had determined when we started discussing the poem that she would not say a word, knowing nothing about poems and feeling scared by them. But as she heard the various things that people were saying, her own thoughts developed, and she finally couldn't contain herself, so much did she have to say and so strongly did she feel about it. One student referred to himself as a "poem-phobe," which prompted another student to say, "If Frost had been able to put what he had to say into a sentence, he would have. So don't worry that you can't."

I recognized that this was the same thought I had about the accessibility of science. It is in acknowledging the complexity of the poem, not "sanding away at the interesting edges," to use Schneier's (1990) words, that we render it accessible. Our understanding seeks to do justice to the complexity that the poet sought to render, and by the same token it belongs to us. Just as the poet seeks to present his thoughts and feelings in all their complexity, and in so doing opens a multiplicity of paths into his meaning, likewise a teacher who presents a subject matter in all its complexity makes it more accessible by opening a multiplicity of paths into it" (Duckworth, 1996, pp. 130-131).

This excerpt consists of, and demonstrates, four distinct assumptions or principles of Critical Exploration: The key is to open up part of the world and make it accessible to learners; learning is an individual effort through collaboration; complex phenomena in the world engage the mind in learning; and finally, understanding the learner's understanding is itself a research finding that is fed back into teaching. These four principles, all

emphasizing the developing nature of learning, are discussed separately below.

Opening the World vs. Opening the Mind

For many clinical methods, the focus is on language that is simultaneously a vehicle, a tool and an object. However, Critical Exploration introduces materials into the interview which the participants then can act on. The introduction of objects alters the features of classic psychotherapy, including play therapy that uses objects such as toys or dolls to diagnose fixations and developmental deficiencies. In Critical Exploration, materials are used as the subject matter of study. The key is to make the object accessible to people while keeping the complex relationships the object contains intact. To ask people what they noticed embodies this key idea. As shown in the example of teaching the poem, the principle is to “open the world” of poetry by providing simple access to this world without simplifying it.

Introducing an object like the poem through the approach of Critical Exploration creates multiple paths into the poem, and opens up a world of possibilities for learners to experience and learn the poem. As the example shows, everyone has something to convey about the poem. This feature shares a similar root both in the work of Piaget’s team and that of some science educators who, with or without Piaget’s influence, ask learners to act on objects and then follow their thinking. And yet, in Critical Exploration, it is “opening the world” (Duckworth, 1990) that stands out, as opposed to the widespread popular message, to “open minds,” and “rouse minds.” Opening up the world means bringing to learners a world of possibilities for them to get engaged with, creating their own connections and following their own meaningful paths. The world is full of possibilities for the mind to explore. The teacher engages students with the habits and peculiarities of the world such as the waxing and waning of the moon, or in the case of the poem, the images, the rhyme, the colors, the relations between different lines and stanzas. To open the world is to enrich the possibilities for the mind to be active and aware of a variety of relationships through its contact with all the possibilities.

David Hawkins (1967) described the world-opening aspect of teaching as focusing on “it”—a subject matter that both teacher and students can share, explore and maintain in continuous learning (e.g., new questions, new connections, new awareness of one’s past understanding, and how others’ understanding is related to one’s own). In Critical Exploration, there must be a sharing of “it” between teacher and students and among the students themselves; in this way, they can follow each other’s ideas

by sharing the same references to the phenomenon. In the sharing, the collaborative work is both intellectual and moral. By "Intellectual," I mean the person's desire and mind's work to grasp the phenomenon at issue and the intricate relationships it presents; by "moral," I mean each participant's respect for the ideas of others in every possible way. This process leads to the next principle.

Collective and Collaborative Endeavor

As already mentioned, Critical Exploration is fundamentally a collective and collaborative endeavor, both from a historical perspective and in its present development and practice. Let us recall Brunshvicg's two principles which Piaget followed in his work: (1) that the historical-critical method focuses on the transformation of early ideas and reasoning and their influences on the formation of those that follow; and (2) that scientific objectivity cannot be achieved without collaborative work in understanding, verifying and improving each other's reasoning. Both these principles are as essential and evident in Critical Exploration as they were in Piaget's life-long research. Between these principles—transformation and collaboration—lie the influence and incorporation of ideas that take place in the process. One person's ideas can be instrumental in influencing the formation or transformation of one's own later ideas, or those of others. To understand the effect of this kind of influence in learning, the teacher uses Critical Exploration in order to follow closely how the early ideas develop into the later ones in one person as well as in a group.

In the process of noticing something in Frost's poem, the students, including self-proclaimed "poem-phobes," began to see phenomena emerging from the poem. But the increase of notable phenomena, not apparent at the outset, evolved through contributions from many individuals. The diverse observations made by the learners of the poem demonstrated a natural collaboration; and their feelings, including those of the teacher, toward the poem changed through this collaboration and moved the participants' thinking forward. They cannot but look at each other as learners whose thoughts, feelings, confusions and insights intersect with one another (see also Duckworth, 1990).

Throughout the critical exploration activity like the poem session, there is always an emphasis on maintaining harmonious relationships among all the participants even though the teacher is more focused on the flow of students' ideas and their interactions, while the students are more focused on the object of study. A harmonious dynamic cannot be sustained without mutual respect among the participants. New ideas cannot be advanced without each person seriously valuing his or her own ideas

as well as those of others. Moreover, only through this kind of group work do people further develop their respect for each other's human intellectual integrity and the relativity of scientific objectivity as Duckworth noted earlier. Critical Exploration embodies an endeavor to balance and benefit the group and the individual, so that neither is emphasized at the cost of the other. This effort is hard to conceptualize, and even harder to practice. But it exemplifies a central principle of Critical Exploration—always to keep the complexity in view.

Keeping “It” Complex

Keeping “it” complex is fundamentally an epistemological issue. Since the beginning of universal schooling in many countries, particularly at the elementary and secondary levels, prescribed curricula have not given much attention to how children learn in particular or how people learn in general. Although the diverse expressions of the progressive movement in the first part of the 20th century made remarkable forays into elementary schools, and its influence continues to be present in early education (Nager & Shapiro, 2000), its momentum has not been a constant through the rapid societal changes. As a result, how people come to learn something in school is decided more by an authority which sets up the curriculum rather than by those who try to teach and learn.

Critical Exploration exemplifies one significant effort to restore the balance by studying teaching and learning with people directly involved. This effort may not be new on the surface because “student-centered,” “cooperative learning” and “community of learning” all seem to present a similar flavor. Idiosyncratic to the Critical Exploration approach, however, is its principle of keeping “it”—the subject matter—complex through the efforts of both the teacher and students. In exploring the Frost poem, the complexity of the subject matter first came from the intricacy of the poem and then it became palpable and intriguing as participants began noticing more and more phenomena. Thus, the principle of emphasizing complexity is after all an acknowledgement of people's multiple ways of knowing. “It” is complex because people's needs and experiences are complex, thus the ways in which they grapple with “it.”

The teacher's teaching is correspondingly complex because her teaching is part of the learning and research. A modified chart (see below) may illustrate this point by showing the six-way interactions. For the teacher, the continuous interactions including those involving her as shown by the arrows can be more than six ways. She will study the learner's effort to understand the object, and the interaction between them (3). At the same time, she will closely observe the other interactions (1) and (2).

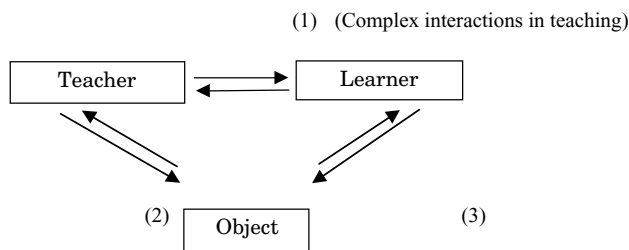


Figure 2.

Critical Exploration is also to be distinguished from discovery learning and conventional teaching in that it treats teaching and learning as a unity, and as a constantly changing process through interaction. Teaching improves with the teacher's participation in her students' thinking processes, and reflections on their active hand-head-heart involvement in learning; and learning progresses through the teacher's learning of her students' experience with the subject matter, with their own thinking, with one another, and with her teaching. Therefore, it is not an act of discovering what is out there in the reality, but a process of developing ideas that proceed slowly with increasing complexity through different ways of knowing.

Although Piaget did not plunge into any concrete educational research, his long-time interest nevertheless led him to this insightful comment about future education: "It seems clear that the future of the teaching of the sciences will depend more and more on their epistemology, something of which there are already many indications" (Piaget, 1976, p. 27). Today, decades later, looking at the acceleration of various constructivist teaching movements since 1973 (Hsueh, 1994), we may find it hard to disagree with him, and also add that his vision proves to have gone beyond the teaching of science. There is no question that discourse about constructivism in education is rightly about epistemology (see Ariasian & Walsh, 1997; Hawkins, 1994; Reid, Kurkjian & Carruthers, 1994; Tobin, Tippins & Gallard, 1993; von Glasersfeld, 1995). Learning from the world can be infinitely complex. This complexity provides ample resources for people to develop their own ideas about various relationships through their own ways of knowing. To help people develop their ideas, the teacher not only needs to find curriculum materials like the Frost poem that lend themselves to maintaining the complexity of learning activities, but also needs to understand students' learning in order to facilitate it. In this sense, a main part of Critical Exploration is research.

Teaching-Research

Teaching-Research, another name for Critical Exploration in the classroom, can be distinguished from various kinds of research of and for teaching. Teaching-research activity is similar to Piaget's clinical examination and his colleagues' method in that it is both experimental and observational. In a learning and teaching scenario, the teacher presents a problem, makes guesses, explores them and evaluates each guess by testing it against the reactions through her own participation in the shared activity. It is a deliberate and critical endeavor to understand learners' understandings, by researching learners' thinking as if she were Piaget at work (Duckworth, 1996, pp. 83-97).

To be sure, the use of teaching-research in the classroom has a different goal from Piaget's research program: Teaching-research is to understand the learner's understanding for the purpose of getting the learner engaged in further learning. This purpose mandates another unconventional practice in research: applying the findings to the students' learning activity as soon as they arise. In other words, the teacher's research findings are applied to the current activities the learner is engaged in. This direct and immediate application (not merely explanation or implication) of research findings distinguishes Critical Exploration from the widely accepted research in education that relies on third-party inquirers to examine learning and teaching from the outsider's point of view.

Conventional inquiry in the social sciences values the outsider's objectivity in the belief that it can offer explanation, rather than description. However, advocates for humanistic or phenomenological research argue that the researcher and the participant are inseparable. Since the research is a meaning-making process, the phenomenologically-inclined researcher values descriptions from the research participants (Giorgi, 1985), instead of the researchers' self-report as explanation. Thus, it may be argued that phenomenological research with its close examination and interpretation of the real "life-world" (Becker, 1986; Osborne, 1990; Polkinghorne, 1989, 1994) is philosophically akin to Critical Exploration in education. The teacher can explore two kinds of thinking simultaneously: that of others and her own. By exploring other people's thinking in interaction with objects, she examines and adjusts her own exploration, her examination of the learning process. The last two paragraphs in the above excerpt from Duckworth show how the teacher relates her own learning and thinking to the students' learning and thinking.

And yet, three differences in teaching-research also stand out from these phenomenological approaches. First, with its direct application, teaching-research distinguishes itself from phenomenological research in

that it is not just to learn and understand participants' understandings and to report an accurate and insightful description. Rather, the findings are applied immediately or later to further the participants' learning. Second, therefore, learning, teaching, and research are intertwined in one unified activity that not only aims at developing the participants' knowledge, but also facilitates the development of a meaningful and interesting curriculum to advance multiple ways of learning from participants' points of view. Third, to achieve these goals, the teacher makes strenuous efforts to study both personal and collective learning over an extended period of time. This is why teaching-research, synonymous with Critical Exploration, has also been called extended clinical interviewing (Duckworth, 1996).

CLOSING REMARKS

No matter what names we have used for this approach, it does not evoke familiar images or a commonplace sense of school teaching. Established notions of "teaching," "learning," "research" and "clinical interview" already exist. However, established views often ignore human inquiry that is fundamentally multidimensional and evolving. In contrast, Critical Exploration focuses on furthering the multiple interpretations, by one or more learners, of the phenomenon they are encountering and acting on. The teacher's function is not to help the learner find a single correct meaning, but rather to find many, and to foster creative and collaborative efforts in learning.

The mind thrives in making connections among the ensemble of symbols that it develops over time; any single analogy, metaphor, or symbol, is almost always part of a larger family of such thought forms (Gruber, 1988; Gruber & Wallace, 2001) . . . In other words, any single idea is part of the individual's other thoughts about a given issue; and probably part of extended thoughts and feelings of others as they develop. Thus, the ensemble of multiple symbols and metaphors can be infinitely complex. Human learning thrives on this complexity and multiplicity. Duckworth (1996, 2001) and her colleagues demonstrate how this approach can effect learning—by studying the diverse symbolic meanings that people of different ages and occupations develop on different subjects at various places.

Critical Exploration thrives on tapping the ensemble of symbols that students develop in the classroom. This approach encourages and inspires students' creative thinking about the subject matter they study. Looking back from the present to the past of the development of this approach in education, we recognize the continual transformation of the Piagetian

tradition. In his own view of education, Piaget was probably more insistent on promoting human potentials than being realistic about established schooling when he argued: "But for me, education means making creators, even if there aren't many of them, even if the creations of one are limited by comparison with those of another. But you have to make inventors, innovators, not conformists" (Bringuier, 1980, p. 132).

The making of creative people needs to be fueled by the creative spirit of the educator who seeks an inventor and an innovator in everyone, even in their own small way. One of the foremost scholars of creative thinking, Howard Gruber (2001) recommends Critical Exploration to "teachers and others who want to come to grips with fundamental problems facing all undefeated educators: What is thinking? How does it grow? How can learners, including the teachers, help each other?" By focusing on these fundamental issues in learning, this approach motivates educators to become inventors and innovators as well.

Critical Exploration is grounded in the process of teaching and learning, and practiced to inform teaching and learning. As Duckworth defined it in the beginning of this chapter, the approach deals directly with two major issues in school: curriculum and pedagogy. But it adds to them an emphasis on the development of human learning. So the two essential aspects of Critical Exploration in the classroom are *developing* curriculum and *developing* pedagogy. For those who have experienced the approach either as teacher, or student, or both, it is a promising approach not only for school, but for life.

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